**AP Statistics: Ch. 13 Experiments & Studies**

**STUDIES**

**Observational Study:**

**2 types of Studies:**

1. **Retrospective Study:**
2. **Prospective Study:**

**Example:** Researchers looked at records of tenants at an apartment building over the past 5 years to determine if the landlord had a preference in the race of his tenants.

**Example:** A local school identifies 50 kindergartners who are considered "at risk" students, and tracks their progress thru high school graduation to see if the programs already in place in the district help these students.

**Example:** You work for a botanical company and with your team you have developed a new type of potting soil, specifically designed to improve the growth and development of roses. An experiment needs to be designed to show that your soil works well compared to the leading competitor. How can you design a good, random experiment?

Some vocab…

**Experiments:**

* Imposes …
* Manipulates …
* Randomly …
* Compares …

***Experimental Units-***

***Subjects-***

***Factor-***

*Example: measuring the affect of 2 fertilizers and 3 water amounts on plant growth.*

**Level –**

**Treatments-**

*Example again:*

**Response Variable-**

*Example again:*

When Designing Experiments….

**PRINCIPALS OF EXPERIMENTAL DESIGN**

1. **CONTROL:**
2. **RANDOMIZATION:**
3. **REPLICATION:**

Some more vocab…

**Control Group-**

**Placebo-**

***EXPERIMENTAL DESIGNS***

1. **Completely Randomized Design (CRD)**

Randomly and evenly assign exp. Units to treatments.

**Design:**

**Example: 36 rose plants, testing 3 different types of soil, measuring size and health**

**OTHER:**

**SINGLE BLIND:**

**DOUBLE BLIND:**

**Example 1:** I want to test out a new plant food. So I take 20 plants, and give half the new plant food and half no food at all. All of the plants get the same amount of water and sunlight each day. After 30 days, I measure the height that the plant has grown, and also how many flowers it has on it.

Individuals: Factor(s):

Level(s): Treatment(s):

Response Variable:

Design the experiment:

**Example 2:**

High cholesterol level in people can be reduced by exercise or by drug treatment. A pharmaceutical company developed a new cholesterol-reducing drug. Researchers would like to compare the effects of the new drug with the currently used and accepted drug. 100 Volunteers who have a history of high cholesterol and who are currently not on any medication will be recruited to participate.

What are the treatments? What are the subjects/individuals?

What is the response variable?

Would a placebo group be appropriate/necessary? Why or why not?

Design the experiment below:

1. **Two Factor Design:**

**Design:**

Example: 36 rose plants, testing 3 different types of soil and 2 amounts of water (none or once a day). Still measuring size and health of plant.

1. **Block Design (Blocking)**

**BLOCK = a group of similar experimental units that would have an effect on the results.**

**Examples: gender, age, breeds, etc.**

Design: Example: Block the roses we have used before based on type of rose (alba rose and rock rose)

**Example 3:**

Let's go back to the experiment on people with high cholesterol. We wanted to test the effect of new and old drug. We also thought a control group would be useful. There are 100 volunteers with high cholesterol that are currently not on meds that are available.

Individuals:

Treatment(s):

Response Variable:

What are some lurking variables in this experiment?

Using this variable, create a block design experiment

**Example 4:** Men and women respond differently to advertising. An experiment to compare the effectiveness of 3 TV commercials for the same product will want to look separately at the reactions of the different genders, and assess their overall responses to the ads. There are 70 people available for the experiment.

What are some lurking variables in this experiment?

Using this variable, create a block design experiment

1. **Matched Pairs Design**

* Usually only 2 treatments
* Each experimental unit gets both treatments
* Randomize which treatment comes 1st or 2nd (or L or R, or back/front, etc.)
* Can also be where two subjects with equal characteristics are given different treatments and then compared.

**Design: EXAMPLE:**

**Example 5:**

We want to test the effectiveness of two types of tires (call them A and B) on cars. We gather 50 different cars for our experiment. We will be measuring the amount of wear on the two types of tires. The cars will be driven normally for 3 months. How could we BEST design this experiment?

1. What are the individuals? What is the response variable?
2. What are the treatments?
3. Design the experiment (matched pairs):
4. Can this experiment be single or double blind?

**Example 6:**

Go back to the car tires experiment. Suppose the cars were all different (SUVs, sports cars, sedans, trucks, etc.). How would you reduce this lurking variable of car size/type?

**The best experiments are usually**:

Randomized

Double-blind

Comparative

Placebo-controlled

Some more vocab…

**Confounding-**

**Lurking Variable-**

**Statistically Significant-**

***Example: #41 in book:***

A study published in *New England Journal of Medicine* suggests that it's dangerous to enter a hospital on the weekend. During a 10-year period, researchers tracked over 4 million emergency admissions to hospitals in Ontario, Canada. Their findings revealed that patients admitted on weekends had a much higher risk of death than those who went on weekdays.

1. The researchers said the difference was statistically significant. What does this mean in context?
2. What kind of study was this?
3. If it is Saturday, and you are feeling really sick, should you wait til Monday to see medical help?
4. Suggest some possible confounding or lurking variables.